

2013 Cecil B. Day Research Prize

Title: Drug Disposal: Addressing Current Drug Disposal Practices and Pharmacovigilance

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Objective

The purpose of the study is 1) to review current drug disposal best practices in the United States, 2) to assess effects of drug disposal on human health, and 3) to discuss how pharmacists may implement proper drug disposal techniques to promote pharmacovigilance.

Information Strategy Methods

Online searches using ScienceDirect, PubMed, and Cumulative Index to Nursing and Allied Health Literature (CINAHL) were performed to obtain full text literatures that were conducted over the time frame of January 2001 through January 2013.

In order to obtain literatures that focus on the environmental perspective of drug disposal practice, the search terms "ecotoxicology", "human pharmaceuticals", "water", "risk", "health", "drug disposal" were used in the expert search function in ScienceDirect. The results were limited to journal type only and the publication date was limited from 2001 to the present.

Also, the search terms "drug disposal", "environment", "aquatic", and "United States" were used in the expert search function in ScienceDirect. The results were limited to journal type only and the publication date was limited from 2001 to the present. However, the search results

revealed a major limitation of the search engine. Although 533 articles were generated, the search engine failed to exclude studies that were conducted in countries outside the United States. Thus, each result was manually filtered by verifying the affiliation of the authors and identifying the location of the study in the abstract.

Literature regarding patient practices and beliefs on medication disposal was found through PubMed's search using key terms of "U.S.", "Pharmaceutical preparations", and "medical waste disposal" using the free full text available filter. The search displayed an article that was of particular interest to the study found on the Journal of the American Board of Family Medicine. From the article's link on PubMed, related links to other studies were followed to find an additional one on the topic of drug disposal in the Journal of the American Pharmacists Association.

In Cumulative Index to Nursing and Allied Health Literature (CINAHL), the search term "drug disposal" and the field "AB Abstract" were used to obtain one literature that addressed the proper drug disposal program in community pharmacy. This particular literature was published in the Internal Journal Pharmaceutical Compounding and was accessed from the Monroe F. Swilley, Jr. Library holdings.

Information regarding proper drug disposal methods including the National Prescription Drug Take Back days and proper household disposal methods was found on the U.S. Food and Drug Administration (FDA) website.¹

Results

Sixteen studies were identified for review. According to some studies,²⁻⁴ a few active pharmaceutical ingredients have been found in trace amounts (ng/L) in drinking water and groundwater. Another study found significant amounts of estrogen contaminants in fish exposed to sewage treatment plant water.⁵ In spite of these reports, additional findings^{2,6} revealed that trace amounts of drugs do not impose a negative health risk on human health with respect to environmental exposure in drinking water and fish consumption. However, these outcomes have only been explored in short term studies occurring no longer than two years.^{2,6}

Studies^{3,7-10} show that pharmaceuticals enter the aquatic system via several pathways. The primary routes from humans are the excretion and disposal into wastewater following therapeutic use. (Figure 1)

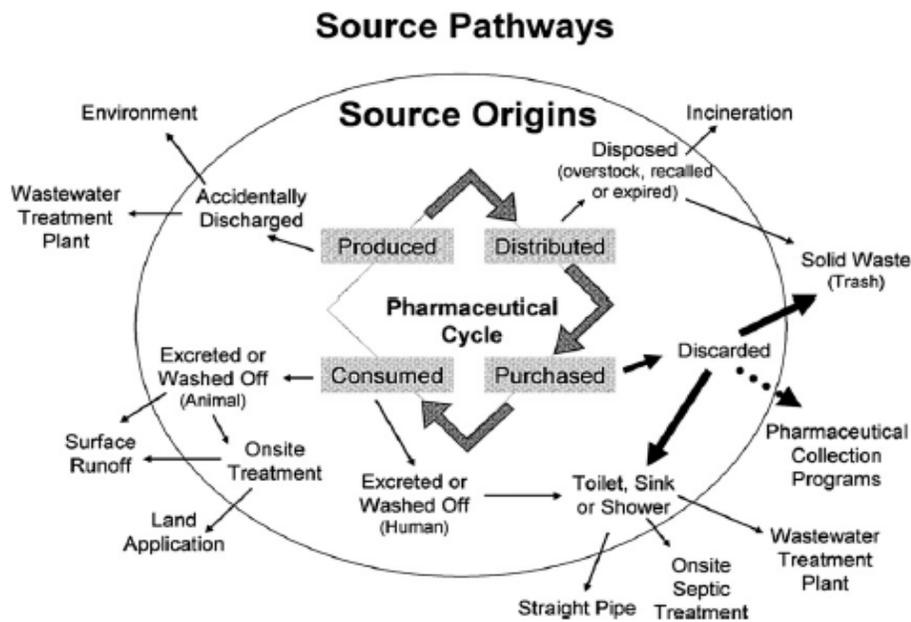


Figure 1. Routes of a drug entry into environment. Once purchased and/or consumed, pharmaceuticals can enter into the environment from a household via excretion, wash-off, and/or disposal of unwanted or leftover.⁷

The most commonly utilized household drug disposal methods were disposal in the garbage, toilet and sink.^{7,9-13} (Figure 2) A survey of hospice home care nurses¹⁴ reported that the nurses always or often disposed unused drugs in the sewage. However, a recent study¹⁰ reported that disposal methods of controlled substances pose conflicting recommendations in hospitals. Despite the Material Safety Data Sheets provided by pharmaceutical manufacturers recommending incineration as the immediate disposal method for certain controlled substances, the most standard method of disposal is the toilet and sink¹⁰.

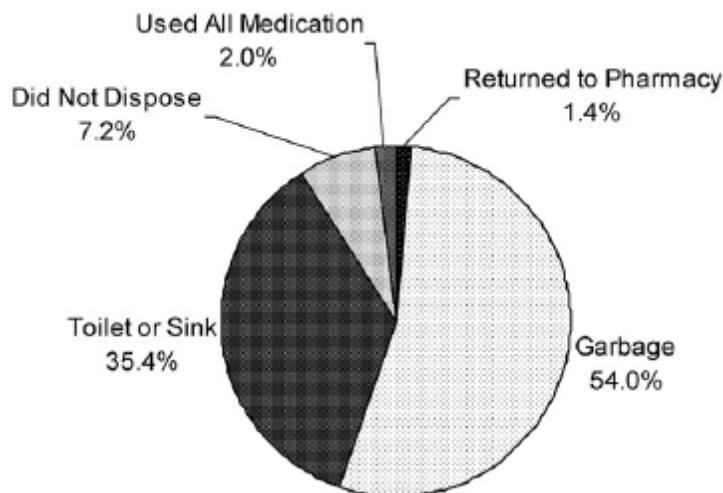


Figure 2. A questionnaire survey report on unused drug disposal methods. Garbage (54.0%) was the most common method followed by the toilet or sink (35.4%). Only 1.4% of respondents returned their unused drugs to pharmacy.⁷

In an effort to discourage improper medication disposal, the National Take Back Initiative (Take Back Program) was launched by the Drug Enforcement Agency (DEA) in 2010.¹ The Take Back Program was developed as a way to responsibly and conveniently allow consumers to dispose of expired, unwanted or unused drugs in their household. The FDA recommends the use of Take Back Programs for drug disposal unless the program is not available in the area. In this case, disposal should involve mixing the uncrushed drug with coffee grounds or kitty litter.¹ Controlled substances should be flushed due to the potential for misuse or

abuse. Alternatively, they can be returned to an authorized supplier or reverse distributor for incineration.¹⁰

Hospital and community pharmacists can advocate safe practices in drug disposal by improving patient education, promoting patient use of the Take Back Program and serving as liaisons between consumers/patients and disposal programs. In 2008, the National Community Pharmacists Association (NCPA) created a Prescription Disposal Program for affiliated independent pharmacies to utilize the Take Away disposal box from Sharps Compliance, Inc.¹⁵

(Figure 3)

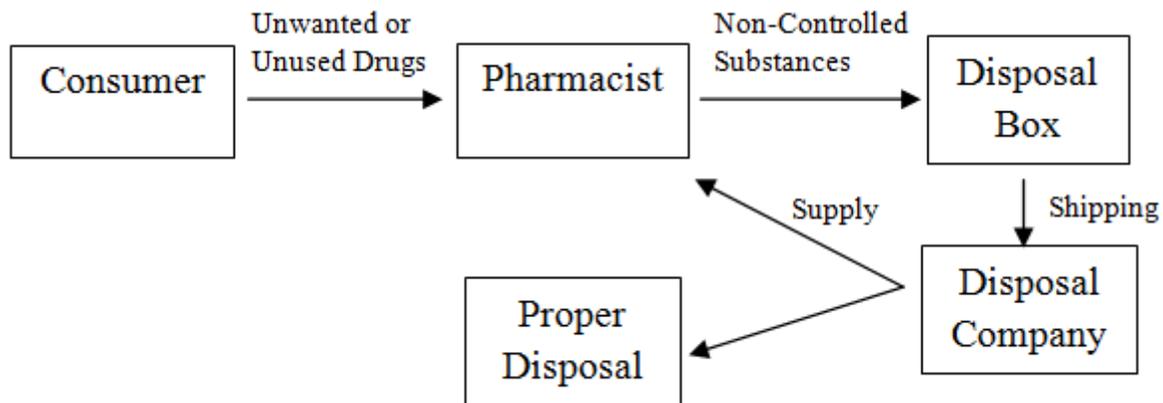


Figure 3. Drug disposal pathway in a NCPA affiliated independent community pharmacy. A consumer brings unwanted or unused drugs to a pharmacy. A pharmacist collects non-controlled substances into a designated box. Once the box is full, it is shipped to a disposal company for proper disposal. The disposal company supplies the box to the pharmacy.¹⁵

Other sponsors of on-going Take Back Programs include the Alachua County Environmental Protection Department of Florida, the Kendall County Health Department and TRIAD of Illinois, the Clark County Washington, the State of Washington, and LaCross County Wisconsin Solid Waste Department.⁷

Conclusion

Findings of active pharmaceutical ingredients in drinking water have increased awareness of pharmacovigilance.^{2,16} As a result, several methods of proper drug disposal have been employed by pharmacies and medical facilities throughout the states. When implementing the Take-Back Programs in communities, few special considerations should be made. First, it is important to target geriatric consumers because they take more prescription drugs than other age groups.¹⁷ Second, the programs should be convenient, inexpensive, and consistently available at the pharmacy in order to increase participation rate.⁸ Third, a pharmacist should be in compliance with the law and familiar with current legal requirements for different disposal method types.^{10,15}

Pharmacists are in an ideal position in providing counseling related to drug disposal. Although patients are often made aware of the potential for abuse of prescription drugs, they are less aware of its environmental issues associated with their disposal.⁹ Therefore, pharmacists may complement their counseling sessions and/or advertisement by making patients aware of the environmental aspects of drug disposal.¹¹ Moreover, factors affecting patient safety as well as environmental safety should be elaborated upon. Additional longitudinal studies are needed to assess the chronic risks of exposure in humans to improperly disposed pharmaceuticals.

Furthermore, pharmacists can use the Take Back Program as a means of improving the outcome of a patient's drug therapy.^{7,8} At the individual level, unwanted or unused drugs are ultimately accrued by a patient's non-compliance and non-adherence to the drug therapy regimen. These behaviors may be influenced by factors such as forgetfulness, deliberate under-dosing, ineffective outcome, adverse drug reactions, psychosocial reasons, complicated treatment

regimens, and/or disease states.⁸ Therefore, pharmacists should expand the scope of the Take Back Program by focusing on data collection and documentation of evidence to categorize collected drugs by their active pharmaceutical ingredients.⁸ This process can provide salient information which can be incorporated into identifying possible reasons for a patient's non-compliance and non-adherence. By determining the major classes of medications that are used, other methods may be supplemented in improving patient compliance for such medications.

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